Zero Retries issue 0074 2022-11-25

Zero Retries is an independent email newsletter about technological innovation in Amateur Radio, for a self-selecting niche audience. It's free (as in beer) to subscribe.

About Zero Retries

Steve Stroh N8GNJ, Editor

Jack Stroh, Late Night Assistant Editor Emeritus

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Request To Send

Apologies for Zero Retries 0073. Admittedly it was a rush job resulting from a quadfecta of significant time sucks occurring in a single week - health issues, house issues, vehicle issues, and travel. Thus I didn't devote the normal amount of time it takes to do (what I consider) a quality job of Zero Retries 0073. I didn't provide *any* context or commentary for We Use Baofeng's "Heart" For Our Projects, but my worse offense was Thought Experiment - Amateur Radio Social Network - *On Amateur Radio*. My treatment of packet radio networks in the 2020s *really* needs a deep dive, probably multiple issues of Zero Retries. In particular I should have discussed what TAPRN is doing in more depth, including having an on-the-record exchange with Tadd Torborg KA2DEW of TAPRN to understand and explain the design decisions behind TARPN's network architecture. As I mentioned to one email correspondent, as the Editor of Zero Retries, I can grant myself a do-over on that article, and will do so in a future issue.

I made ample time for this issue given that publication day will be a busy one for our family as we'll be shifting our (US) Thanksgiving holiday from Thursday to Saturday and most of Friday will consist of a four round trip to SeaTac airport. Thus there was *much* butt-in-chair time expended getting this issue ready in plenty of time and set to auto-publish. When I was satisfied with it, I looked up to see not just the "Near email length limit banner", but the dreaded "**Too long for email**" banner. There's no fudging that, so I was forced to jettison one article and one ZR > Beacon item to a future issue. Some days, I just have too much fun writing Zero Retries.

Speaking of packet radio networks in the 2020s, this recent video seems on point, touching on legacy packet radio, mentions VARA, and what TARPN is doing.

Another interesting video was referred to me with the intro:

> I don't know if I'm more impressed with the TH-D74 handheld or the infectious enthusiasm shown by this guy doing very basic packet stuff with it!

These were *just two* of at least five interesting videos that surfaced recently in my YouTube feed - so many interesting videos… so little time.

ARRL Handbook 100th Edition Followup
As followup to Big Project for Organization X - *Now* It Can Be Told, as a contributor to the **The ARRL Handbook for Radio Communications 100th Edition**, I've now received my complimentary hardback edition, and the electronic edition. The hardback is gorgeous, and it's amazing to hold that much information in (both) hands (it's heavy). It's been more than a decade since I last invested in an ARRL Handbook and I'm having fun refreshing my knowledge of various topics. As for the electronic edition, I opted for the Mac / Linux version, not just because I'm not a regular Windows user, but I suspected that the Windows version would be encumbered by Digital Rights Management (DRM) by installing specific software. Most of the content of the Mac / Linux version is PDF files, which is exactly what I wanted. Now that it's downloaded onto my Mac, content is easily searchable using the Mac's native search capability.

Starlink in Kherson
In general I've decided not to talk much about Russia's invasion of Ukraine here in Zero Retries, other than mentions of the remarkable performance of Starlink in Ukraine in providing "broadband Internet of last resort". There was no better example of how *much* difference Starlink makes than in a recent New York Times article (regrettably, hidden behind the NYT paywall - I'm a subscriber) about the liberation of Kherson. The article included a stark photo1 of at least a dozen people using their phones as they clustered around a Starlink user terminal sitting on the ground. The photograph was striking that you could see the relief on the faces in the photo - this was the first time since the occupation of Kherson that these Ukrainians could contact their loved ones via Internet. Fair use excerpt from the article:

> A large group of residents gathered nearby, a common occurrence wherever there is a Starlink satellite signal and internet connection. The Starlink internet service, which works with satellites orbiting in space to provide online access, has become a digital lifeline for both Ukrainian soldiers and civilians.

That situation will soon be the norm for re-establishing basic Internet access in the aftermath of disasters such as tornadoes, floods, fires, earthquakes… *war*… where wide scale destruction of terrestrial communications infrastructure occurs. It's not even going to require much technical knowledge - just show up with a Starlink user terminal, the Starlink app installed on a phone, and a way to power it, and you can be providing emergency communications.

de Steve N8GNJ

VarAC v6.2.4

VarAC is a application by 4Z1AC that provides chat / email / file transfer via Amateur Radio that interfaces with VARA HF and / or VARA FM as the "transport layer". It's not very obvious from the website, but in addition to working with VARA HF, VarAC also works with VARA FM. The latter is my immediate interest, though I'll certainly have VarAC as a primary capability when I get on HF in 2023.

VarAC "competes" with VARA Chat (Easy Text and File transfer chat) and VARA Terminal (VARA dumb terminal for BBS's) which are companion applications by VARA HF / FM's author EA5HVK.

I've written extensively about VARA FM, including a multi-issue deep dive beginning in Zero Retries 0004, thus I won't rehash that here. The primary takeway regarding VARA FM and VARA HF is that it's primarily a file transport system that excels at moving block oriented data point to point, faster and more reliably than any system I know of in Amateur Radio that works in a 20 kHz channel on VHF / UHF (or much narrower channels on HF).

On 2021-08-10, Irad Deutsch 4Z1AC released v1.9 Beta of VarAC:

> I have created VarAC as I believe Digital HF Chat can be easy and fun. After working with almost every Digital mode out there, I have come to a conclusion that the VARA protocol is the perfect platform for a chatting application.

To learn about VarAC, 4Z1AC provides an attractive, easy to navigate website (really, a model for such projects) including direct downloads, extensive history, forum, and most importantly, documentation. Commendably, 4Z1AC gives credit for others who've contributed to the success of VarAC on a Hall of Fame page.

So, what is VarAC and why is it such a big deal? One big deal is, simply, that 4Z1AC builds on the very robust data communications capabilities of VARA HF and VARA FM. One of the biggest issues with chatting, file transfers, etc. is that they're fraught with peril, especially when you're operating on HF.

VARA HF and VARA FM are about as robust (and fast) as it gets, short of an expensive Pactor 4 modem. Thus a chat system using VARA HF or VARA FM will be a pleasant experience - minimal errors and fast data transfers. Thus 4Z1AC can invest his time in features and usability that make for a more pleasant and useful chat and file transfer capabilities.

My summary of VarAC features:

- Realtime and deferred 1:1 chat,
- Email (VarAC's terminology is "Vmail"), including multiple recipients and relaying via other stations,
- File transfers,
- Group chat (recent addition - see below).

VarAC v6.2.4 adds some significant improvements (excerpts):

> - VarAC Broadcasts - Sending an asynchronous message to a user or to ALL [group chat].
> - SNR Live graph - see SNR reports of you and your QSO partner on a live graph.
> - Pi/Linux compatible mode - Full support of VarAC on Linux/Raspberry using WINE.
> - Translation - "right click text -> Translate" in the data stream and it will show a google translate result.
> - VarAC profiles - easily switch between different VarAC configurations for different RIGs.
> - VarAC Cluster - run multiple VarACs with different ini & rigs while sharing resources. Great for VMail relays across different bands.
>
> BUT one of the game changers in this version is the BROADCAST features which allows you to send asynchronous (non ARQ) messages to one or to ALL. This allows for the first time a GROUP CHAT! Broadcasts are using the same good old protocol that is used by packet radio and APRS - the X25 protocol.
>
> In addition, beyond the many other new features we developed (see list below), we also implemented a SQL based database (Sqlite) for Vmails (first), and soon for other features. Upon startup, VarAC will convert your existing mailbox from the VarAC_mailbox.mbx file into the new VarAC.db SqLite DB file.
>
> This opens up huge opportunities, for software developers who want to integrate their software with VarAC and extend the echo-system. More features will soon utilize this SqLite DB.

There a few… *not issues per se*… but some things to be aware of with VarAC:

- As with VARA HF and VARA FM, VarAC is the product of an individual software author who has chosen not to release source code. Thus it's possible that VarAC development could cease, with no recourse for users who get invested in using VarAC.
- VarAC is designed for Windows. For some that's a feature. For others, that's a downside. It's laudable that 4Z1AC has invested significant effort into making VarAC usable on WINE (Windows emulation on Linux), especially for the Linux version for Raspberry Pi.
- A number of features of VarAC (especially with logging conversations) depend on Internet connectivity.
- Because VarAC is dependent on VARA HF or VARA FM, it's sometimes necessary to upgrade that software to use a new version of VarAC, which sometimes breaks interoperability with users who haven't upgraded their Vara HF or VARA FM..

VarAC is a cool application and I'm looking forward to trying it.

GreenCube - Orbiting Garden and Amateur Radio Payload

I missed this one completely - my thanks to Jeff Davis KE9V for the pointer.

Now *this* is a *research* satellite! An autonomous garden in orbit! With an Amateur Radio digipeater, including store and forward capability. It's a bit of a treasure hunt to get an understanding about the Amateur Radio capabilities of this satellite, so here are the most relevant excerpts I've found.

GreenCube: The Space Micro-garden 6,000 km From Earth:

> The heart of GreenCube consists of a pressurized chamber for the cultivation of micro-vegetables, inside which a series of sensors constantly monitors the environmental parameters. The control system allows you to adjust the main environmental factors, such as light, temperature and the distribution of the nutrient solution, in order to optimize plant growth.

AMSAT-EA Newsletter 2022-07:

> This satellite has a MEO orbit at 6000km from the earth with an inclination of 70° and a period of 228 minutes. It will have a digirepiter on 435.310 Mhz GMSK to 1k2 or 4k8.

Gunter's Space Page - GreenCube:

> The main radioamateur aim of the mission is testing a digipeater system in this "above- LEO" spacecraft, capable to reach a very large portion of the Earth, both in real time and in a "store and forward" configuration.
>
> The radioamateur/educational aim of the mission is testing a communication system capable to download unique pictures of the Earth, taken by an educational (low definition) camera placed externally form the satellite. In addition, the telemetry will be downlinked periodically with

public formats and will provide a clear picture of the behavior of the hardware in the space environment.

Finally, information on the survival of electronics in the inner Van Allen belt, will be gained for radio amateur future missions. The radioamateur/educational return of the mission for the students involved will focus on the experimental activity for the development and management of a digital radio communication system suitable for a distant orbit in a very adverse radiation environment, within the inner VanAllen belt.

S5Lab - Decoding GreenCube:

Decoding GreenCube
GreenCube transmits in UHF at frequency 435.310 MHz using GMSK modulation at 300, 600, 1200, 2400, 4800 or 9600 baud. The bauds change dinamically during passes over Rome depending on the SNR. Any tool used for receiving 1KUNS-PF can be used to receive GreenCube as well, since they use the same transceiver – the AX100 from GomSpace. This transceiver is common among CubeSats and several tools exist to receive and interpret the packets.

Data Link Layer
The data link layer uses an Attached Sync Marker (ASM) to determine the beginning of a packet. The marker is C9D08A7B (MSB).
The next field after the ASM is the Golay-encoded length. This is a 3-byte length field with FEC provided by the Golay 24,12 code.
The rest of the packet is scrambled with the typical G3RUH scrambler.

Network Link Layer
The packet uses the Cubesat Space Protocol (CSP). The header contains information on the source and destination of the packet; the end of the packet is composed of a CRC32, which provides a checksum of the data, and a Reed Solomon (223, 255) field.

S5Lab - GreenCube Digipeater:

GreenCube telecommunication subsystem has a digipeater functionality available to the radioamateur community. It can operate in real-time mode and in "store & forward" mode and requires an amateur radio station with:

- Windows PC
- Directional antenna (10 dBi at least recommended)
- Audio connection between transceiver and PC

GreenCube definitely is Zero Retries Interesting, not only for the communications aspect (and its primary mission, of course), but also the innovative (for Amateur Radio) use of Medium Earth Orbit (MEO) instead of the more typical Low Earth Orbit (LEO).

ZR > BEACON

- The **Yaesu FTM-6000R** is on sale at Ham Radio Outlet through 2022-11-28 for $200! This is one of only a few radios currently in production that provides a "flat audio" connection for higher speed data modes such as VARA FM. To get the standard 6-pin MiniDIN connector requires the CT-164 cable which is $30.
  For comparison, a used Kenwood TK-970 which is a well regarded surplus commercial unit for packet radio (including 9600 bps), is typically around $100 on eBay and requires modifications.

- Calling all space nerds: **New documentary *Good Night Oppy*** will give you all the feels - ***I*** will certainly watch this as soon as it's available on Prime Video.

  > For over 14 years, space nerds and the general public alike were riveted by the parallel journeys of Spirit and Opportunity, twin intrepid Mars rovers who launched and landed on the red planet three weeks apart and surpassed their original 90-day missions by many years. We watched from Earth as they explored the Martian surface and dutifully collected samples before finally giving up the ghost in 2010 and 2018, respectively. Now we can relive that journey all over again—while others can discover it for the first time—in Good Night Oppy, a dazzling, feel-good new documentary from Prime Video directed by Ryan White.

- **ARDC - Rhizomatica: Connecting the Unconnected**
  Great article by Dan Romanchik KB6NU of ARDC about one 2021 ARDC grant to develop a (non Amateur Radio) system for very remote areas that use HF radio links. I was on the 2021 ARDC Grants Advisory Committee (GAC) and reviewed this grant proposal (very favorably). Thus I was aware that a goal of this grant, as stated in their grant proposal, was to develop an open source replacement for VARA HF. That's a big deal as VARA HF is the most robust, highest speed data mode on HF (that I'm aware of, other than hardware modem, and expensive, Pactor 4). Because that goal wasn't explicitly stated in the public disclosures of this grant, and the confidentiality agreement required of GAC members, ***I*** couldn't mention that work. But KB6NU, as ARDC's Communications Manager, can disclose such info, so now it can be told! Here's the money quote, and the big win for why ARDC's grants can be transformative:

  > In addition to making this immediate impact, Rhizomatica is working on projects that they feel will make an impact in the future. One of these projects is an open-source replacement for VARA HF, a high-performance HF modem based on OFDM modulation. They are also working on improving Codec2, an open source speech codec designed for communications quality speech at low bit rates, and are experimenting with using artificial intelligence techniques to develop error correction codes.

- ***Can't… make… this… up…*** In mentioning this, I'm not making fun of those who like and use CW. *Really!* It's just that my imagination just wasn't wide enough to imagine this possibility. At first glance, CW Hotline seems like just another CW keyer. But this unit doesn't connect to a *radio* (at least, directly)… it connects, via Wi-Fi, to the *Internet*!

Image courtesy of Ham Radio Solutions

Ham Radio Solutions is pleased to announce CW Hotline, a WiFi connected CW tool. CW Hotline was designed to provide a way to key a remote radio station in CW mode, but can be also used as a private Morse code link to friends. Think “The Bat Phone” for CW. It is available with either a built in straight key or paddles, or neither if only external keys will be used. Once it is configured with the local WiFi information, just power up, it will link with selected peers and be ready to send and receive.

My thanks to Amateur Radio Weekly for mention of this interesting development (and many others - recommended!)

Feedback Loop

Zero Retries 0073 Comments:

- My collaborator on some "fox-hunting" projects just noticed the device mentioned in the YouTube video from Andreas Speiss HB9BLA.
- Welcome to the Fediverse!

Private emails:

- *mewe.com has quite a few technology/communications groups, including a number of amateur radios ones. Might be worth checking out.*
  The old plaint... so many social media platforms, so little time...
- *Suggest you check out the GreenCube satellite for a Zero Retries story.*
  GreenCube is definitely on the Zero Retries Interesting list!
- *Is there a version of VarAC for VHF / UHF?*
  I *didn't* think so - I can't find any statement on the VarAC web page that VarAC works on VARA FM other than on the title on the website:
  HF/FM Digital Chat Reinvented
  But, on the first page of the website, there are these statements:
  VarAC is a FREE, modern HF P2P real-time chatting application…
  and
  IMPORTANT NOTE: VarAC requires VARA-HF V4.6.5 or higher.
  Not to mention VarAC seems highly optimized for HF.
  So, I sent a brief email to the VarAC support email address and received this reply (verbatim):
  It suppory vara fm and many r using it with vara fm. Under settings loom for the upeer right selector. Dont forget to set the path to the vara fm path.

So, good news for those of us mostly VHF / UHF users - VarAC *is* an option!

- *Although your statement about TCP/IP running over packet radio is true, I giggled when I recalled a time when TCP/IP was implemented to run (slowly) over email.*

  IP over Avian Carriers makes TCP/IP over email to seem progressive 😊

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with wireless technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*
- Pseudostaffers Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" items on his blog that I don't spot on my own.
- Amateur Radio Weekly consistently surfaces "Zero Retries Interesting" stories.
- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

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Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc. I don't use such information in any way other than seeing that most subscribers actually do read Zero Retries.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*
- **Mastodon** - @n8gnj@mastadon.radio and **Twitter** (for as long as it lasts…) - ZeroRetries.

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted in beautiful Bellingham (The City of Subdued Excitement), Washington, USA.

2022-11-25

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1

I'm not including the photo I mention because it's copyrighted by the NYT, and they are very, *very* protective of their copyright. Zero Retries, and I, could not withstand a Digital Millenium Copyright Act (DMCA) takedown notice from NYT.